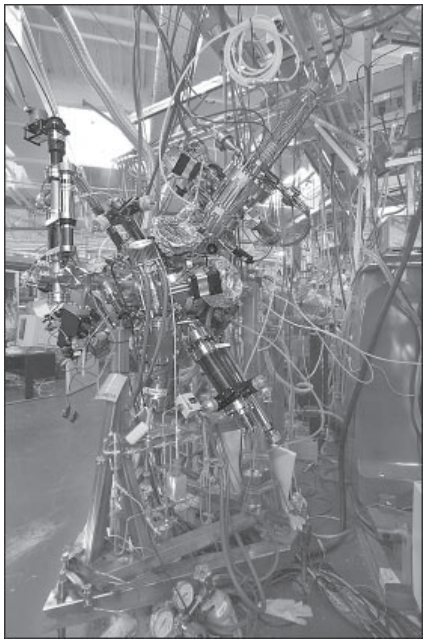
Electron Spin Polarization (ESP) • Beamline 10.0.1

Berkeley Lab • University of California

Endstation Specifications

Photon Energy Range (eV)	Photon Flux (photons/s/0.01%BW)	Spectral Resolution (E/ΔE)	Spot Size (mm)	Availability
17–340	$\leq 10^{12}$ (resolution dependent)	>10,000 (selectable by slit width)	1.5 (h) × 1.5 (v)	NOW



ESP endstation.

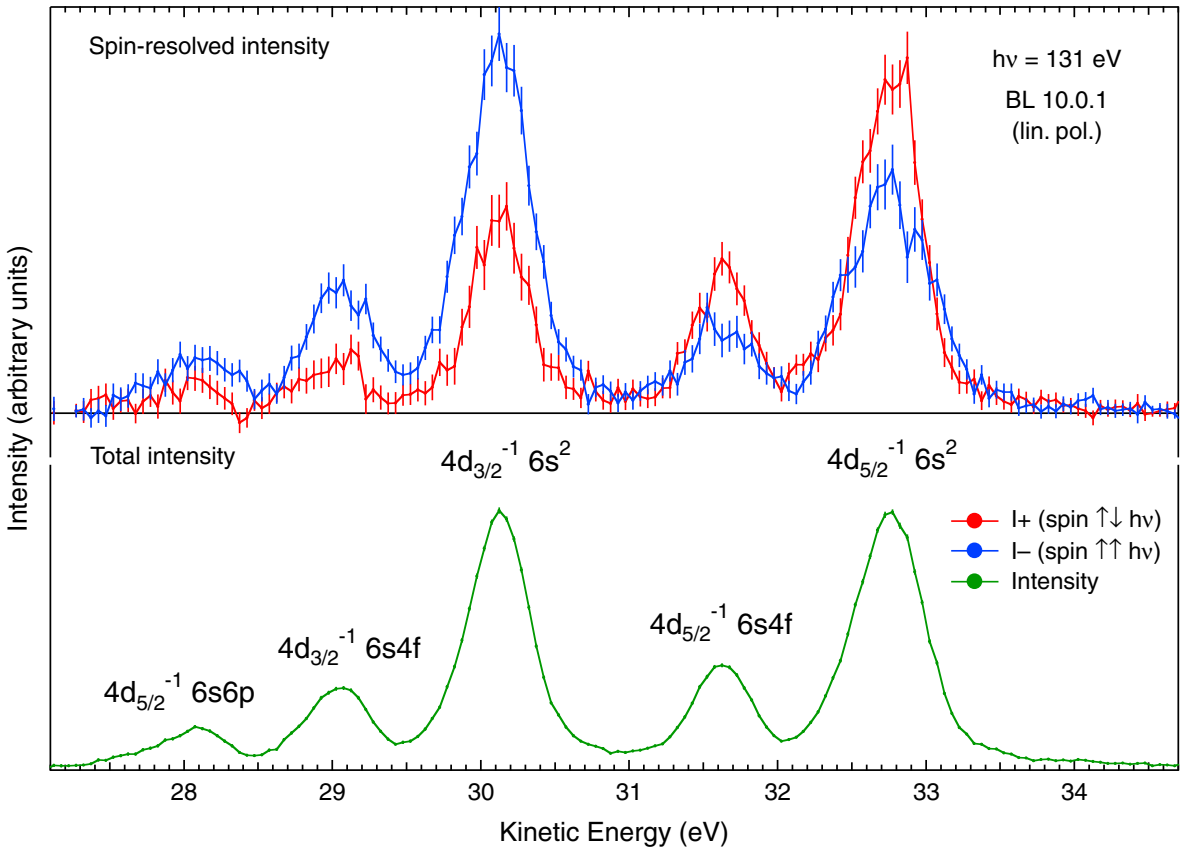
Beamline 10.0.1 contains three branchlines, two of which are dedicated to the Atomic and Molecular Facility (AMF). The remaining branchline (managed by a separate PRT) is dedicated to the High Energy Resolution Spectrometer (HERS) endstation, described in a separate data sheet.

The first AMF branchline serves the High-Resolution Atomic and Molecular Electron Spectrometer (HiRAMES) endstation (described in a separate data sheet). The second AMF branchline serves the Electron Spin Polarization (ESP) endstation and the collinear Ion-Photon Beamline (IPB) endstation (also described in a separate data sheet).

The Electron Spin Polarization (ESP) endstation presently allows measurements of the electron spin polarization in free atoms but will be used for the study of molecules and clusters in the future. The ESP endstation consists of three electron time-of-flight spectrometers (TOFs) mounted at different angles in a vacuum chamber. Two of the TOFs are equipped with retarding-field Mott polarimeters,

allowing measurements of electron spin polarization components. The third TOF acts as a regular electron spectrometer.

This instrument allows very effective data acquisition because all electron lines in the TOF spectrum are spin-analyzed simultaneously with a high signal-to-noise ratio. In a first investigation, the spin polarization of the Xe $5p^{-1}\ ^2P_{1/2,3/2}$ and $4d^{-1}\ ^2D_{3/2,5/2}$ photolines parallel to the photon beam have been measured. The 5p measurements were primarily used to calibrate the polarization sensitivity (S_{eff}) of the Mott detector. The measurements were performed with linearly polarized light at the undulator Beamline 10.0.1. Using linearly polarized light, one component of the spin polarization vector, the so-called "dynamical polarization," can be measured. The origin of this electron spin polarization is a quantum-mechanical interference effect, as opposed to the transferred spin polarization that originates from spin-polarized photons, and can be measured only with circularly polarized light. Spin-resolved Xe $N_{4,5}O_{2,3}O_{2,3}$ Auger spectra taken at another ALS beamline with circularly polarized light demonstrate the successful commissioning of the ESP endstation. ■



Ba 4d spin-resolved photoelectron spectra. *Data courtesy of G. Snell (Western Michigan University) et al.*

This endstation is available to independent investigators by submitting a proposal.

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